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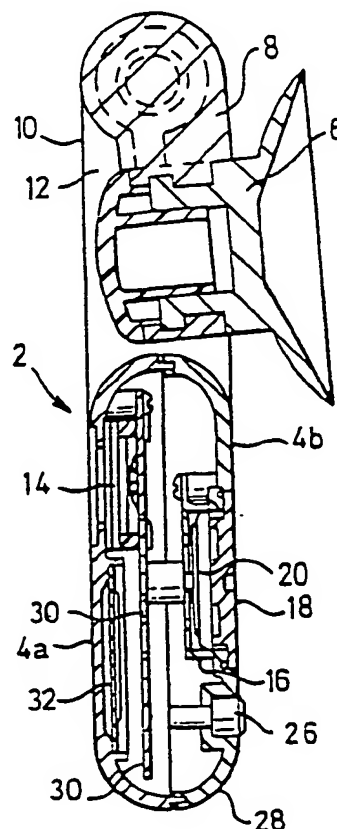
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification 5 : G08B 21/00</p>	<p>A1</p>	<p>(11) International Publication Number: WO 90/13881 (43) International Publication Date: 15 November 1990 (15.11.90)</p>
<p>(21) International Application Number: PCT/GB90/00713 (22) International Filing Date: 8 May 1990 (08.05.90) (30) Priority data: 8910517.5 8 May 1989 (08.05.89) GB (71) Applicant (for all designated States except US): SOLAR WIDE INDUSTRIAL LTD. [GB/GB]; 10/F. 1007-12 Mita Centre, 552-566 Castle Peak Road, Kwai Chung, N.T. (HK). (72) Inventor; and (75) Inventor/Applicant (for US only) : SHALVI, Ram [IL/GB]; 10/F. 1007-12 Mita Centre, 552-566 Castle Peak Road, Kwai Chung, N.T. (HK).</p>		<p>(74) Agent: LUCKHURST, Anthony, Henry, William; Marks & Clerk, 57-60 Lincoln's Inn Fields, London WC2A 3LS (GB). (81) Designated States: AT (European patent), AU, BE (European patent), CA, CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), IT (European patent), JP, LU (European patent), NL (European patent), SE (European patent), US. Published With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</p>

(54) Title: LIQUID MONITORING DEVICE

(57) Abstract

A liquid monitoring device includes means (22, 24) for detecting the presence of a liquid and means (34, 32) for giving an alarm when the liquid is detected. Preferably a temperature sensor (26) is also provided and the temperature is displayed on an LCD (14). The temperature sensor (26) is arranged to sense the ambient air temperature at a first sampling rate and then the liquid temperature, after the liquid has been detected by means (22, 24), at a second, more frequent sampling rate. The components are housed in a casing (10) which carries a pivotably mounted sucker (6) for attachment to a wall or bath.



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Liquid Monitoring Device

The present invention relates to a liquid monitoring device.

The invention provides a liquid monitoring device comprising detecting means for detecting the presence of a liquid, and alarm means for indicating when liquid is detected by the detecting means. Preferably there is also provided temperature sensing means for measuring temperature, and display means for displaying the measured temperature.

Preferably the device includes housing for housing component parts of the device and mounting means on the housing for removably mounting the device on the wall of a vessel, such as a bath. Preferably the mounting means is pivotably mounted on the housing. Preferably the mounting means comprises a sucker which is pivotably mounted on the housing. Preferably, the detecting means, alarm means, temperature sensing means and display means are electrical or electronic devices and are preferably powered by an on-board battery power supply.

The alarm means may be an audible alarm such as a buzzer which sounds when liquid is detected. Means may also be provided for indicating audibly and/or

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visually when the detected temperature is above or below a predetermined value.

Other preferred features and advantage of the invention will be apparent from the following description and the accompanying claims.

The invention will be further described by way of example with reference to the accompanying drawings, in which:-

Figure 1 is a front view of a liquid monitoring device forming an embodiment of the invention;

Figure 2 is a rear view of the device of figure 1;

Figure 3 is a side view of the device of figure 1;

Figure 4 is a cross-section along the line IV-IV of figure 1 on an enlarged scale;

Figure 5 is a schematic circuit diagram for the device of figure 1; and

Figure 6 is a schematic circuit diagram of another monitoring device.

Referring to the drawings, a liquid monitoring device

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2 forming an embodiment of the invention comprises a plastics housing 4 formed by front and rear half shells 3a and 3b which are welded together to form a watertight joint.

A sucker 6 is attached to an arm 8 which is pivotably mounted on an upper end 10 of the housing 4. The arm 8 pivots in a slot 12 in the housing.

A liquid crystal display 14 is mounted on the front half shell 4a. The rear half shell 4b carries a battery compartment 16 which is closed by a removable cover 18 and houses a battery 20. Two contacts or electrodes 22, 24, and a temperature sensitive transducer 26 extend through the wall of the rear half shell 4b and are positioned near the lower end 28 of the housing 4. Transducer 26 is positioned below contacts 22, 24 so that it will be covered by liquid when the contacts 22, 24 are bridged by the liquid.

A printed circuit board 30 carrying electronic circuitry for the device and a buzzer 32 are mounted inside the housing 4.

Referring to Figure 5, the temperature sensitive transducer 26 is connected to an integrated circuit IC1 which displays the measured temperature on the

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liquid crystal display 14.

The presence of liquid is detected by contacts 22, 24. When the contacts are immersed in liquid such as bath water which forms a relatively low resistance path between the contacts, contact 24 is earthed which triggers an oscillator 34 which sounds buzzer 32 for a predetermined period, preferably about 10 to 20 seconds.

Earthing of terminal 24 also signals IC1. IC1 is arranged to measure the temperature, through contact 26, about once every 10 seconds whilst contact 24 is high (not earthed) and display the (new) measured temperature on display 14. When contact 24 goes low (earthed through the liquid and contact 22), IC1 measures the temperature about every 1 second.

An on-off switch (not shown) may be provided to conserve power when the device is not in use. Also IC1 may be adapted to drive the buzzer, preferably at different frequencies, to sound an alarm when the measured temperature falls below or goes above preset limits. Additional switches may be provided for setting the preset limits.

In use, the device is mounted on a wall by means of sucker 6, for example inside a bath or at ground

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level on a room wall. The housing 4 may be pivoted around to enable the display 14 to be read easily and adjust the height of contacts 22, 24, 26. The ambient air temperature will be sensed about every 10 seconds and displayed on display 14. The display displays the temperature continuously and is updated by ICI after each sampling. When liquid forms an electrical path between the contacts 22, 24, the buzzer 32 is sounded for about 10 seconds. At this time contact 26 will be immersed in the liquid and the temperature is sensed every one second and displayed on the display 14.

Referring to Figure 6, another monitoring device comprises a microcontroller 40, connected to a temperature sensor 41, which drives a liquid crystal display 42 for displaying the temperature sensed. The presence of liquid adjacent the sensor is detected by a liquid level detector 43 provided with electrical contacts 44 which are both covered by the liquid when it reaches a desired level. A driver 45 and buzzer 46 are provided to produce audible signals as explained below and a melody chip 47 and speaker 48 are also provided. A range selector 49 to set three chosen temperature ranges of the monitoring device provides input signals for the microcontroller 40. A crystal oscillator 50, a battery 51 and a battery condition detector 52 are connected to the

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microcontroller 40.

In use, any one of three ranges of temperature can be keyed in by the selector 49. The ranges are identified as an infant, a toddler and an adult range. When the sensed temperature is high, and beyond the upper end of a selected range, HIGH is displayed on the display 42. When the temperature is low, and beyond the lower end of the range, LOW shows on the display 42. If temperature sensed is within a presently selected range, SAFE shows on the display 42.

At the same time or alternatively a melody or soft alarm is provided by the speaker 48. For example, if temperature is high, beyond the range, the melody or soft alarm lasts for, say, 15 seconds and is repeated every minute for as long as the temperature remains high.

Typical chosen temperature ranges are for infants 36° to 38°C, for toddlers 34° to 40°C and for adults 32° to 42°C.

The audible alarm and/or melody output are normally arranged to provide a different noise pattern or frequency, or a different melody to correspond to

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different situations. The user can then identify from the different audible alarms or melodies what the conditions are that are being monitored without needing to look at the display 42. This may be very useful when the user is unable to see the mounting device because it is out of view or the user has no or poor eyesight.

The liquid level is determined by measuring the effective impedance between exposed electrodes 22 and 24, or electrodes 44. In the described arrangements this is carried out by applying a voltage in which the polarity is changed. As a result, there is little or no tendency for the exposed electrodes to corrode.

Various modifications may be made to the described embodiment and it is desired to include all such modifications as fall within the scope of the accompanying claims. For example, the devices may be arranged to sense the liquid by detecting a change in capacitance between the contacts 22, 24, or the contacts 44.

Claims

1. A liquid monitoring device comprising detecting means for detecting the presence of a liquid, alarm means for indicating when liquid is detected by the detecting means, temperature sensing means for measuring temperature and display means for displaying the measured temperature.
2. A device as claimed in claim 1, including a housing for housing component parts of the device and mounting means on the housing for mounting the device on a wall or the like.
3. A device as claimed in claim 2, wherein the mounting means comprises a sucker.
4. A device as claimed in claim 2 or 3, wherein the mounting means is pivotably mounted on the housing for pivotal movement of the housing relative to a said wall or the like.
5. A device as claimed in any one of claims 1 to 4, wherein the alarm means and the temperature sensing means are electrical or electronic devices and are powered by an on-board battery power supply.
6. A device as claimed in any one of claims 1 to

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5, wherein the alarm means is an audible alarm.

7. A device as claimed in claim 6, wherein the alarm sounds for a limited period of time on detection of the liquid.

8. A liquid monitoring device according to any one of claims 1 to 7, in which the liquid measuring means comprises two exposed electrodes and the level is detected by the change in effective impedance therebetween when they are connected by the liquid, including means for applying a voltage across the electrodes with alternating polarity when measuring the impedance.

9. A device as claimed in any one of claims 1 to 8, wherein the temperature sensing means is arranged to sense ambient air temperature and then to sense the liquid temperature when the liquid has been detected by the detecting means.

10. A device as claimed in claim 9, wherein the temperature sensing means samples the air temperature at a first predetermined rate and samples the liquid temperature at a second predetermined rate.

11. A device as claimed in claim 10, wherein the first predetermined sampling rate is less than the

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second predetermined sampling rate.

12. A device as claimed in any one of claims 1 to 11, including means for indicating when the measured temperature is above or below a predetermined value.

13. A device as claimed in any one of claims 1 to 12 including means for selectably setting different temperature ranges for use respectively with different classes of users, and means for indicating whether the temperature is within the selected range or not.

14. A device according to claim 13 including a display arranged to indicate selectively whether the temperature is above the selected range, within the selected range or below the selected range.

15. A device according to claim 14, in which the indicating means is arranged to produce an audible output.

16. A device according to claim 15 in which the audible output is provided by a melody generating circuit.

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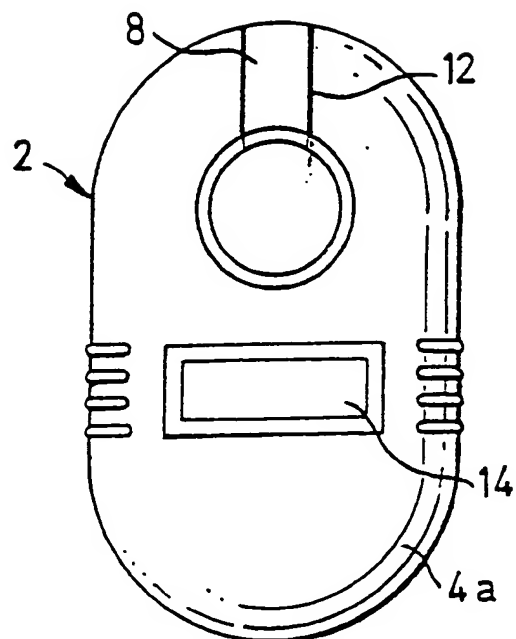


FIG. 1

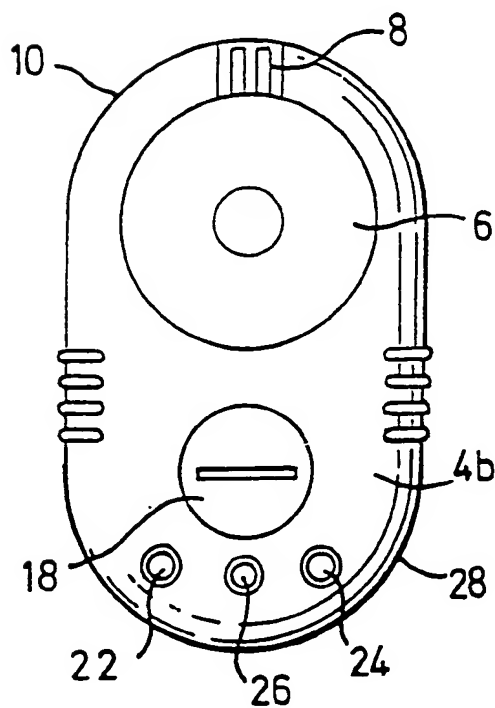


FIG. 2

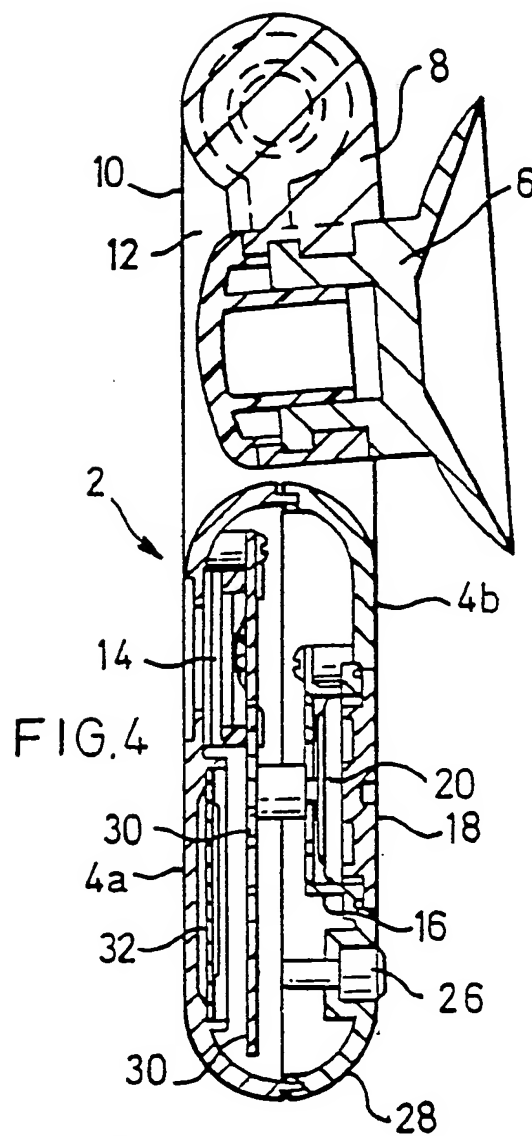


FIG. 4

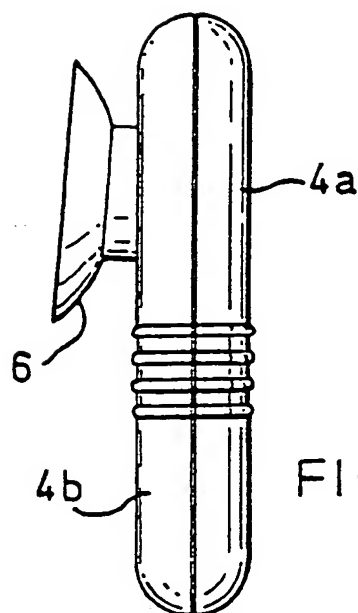


FIG. 3

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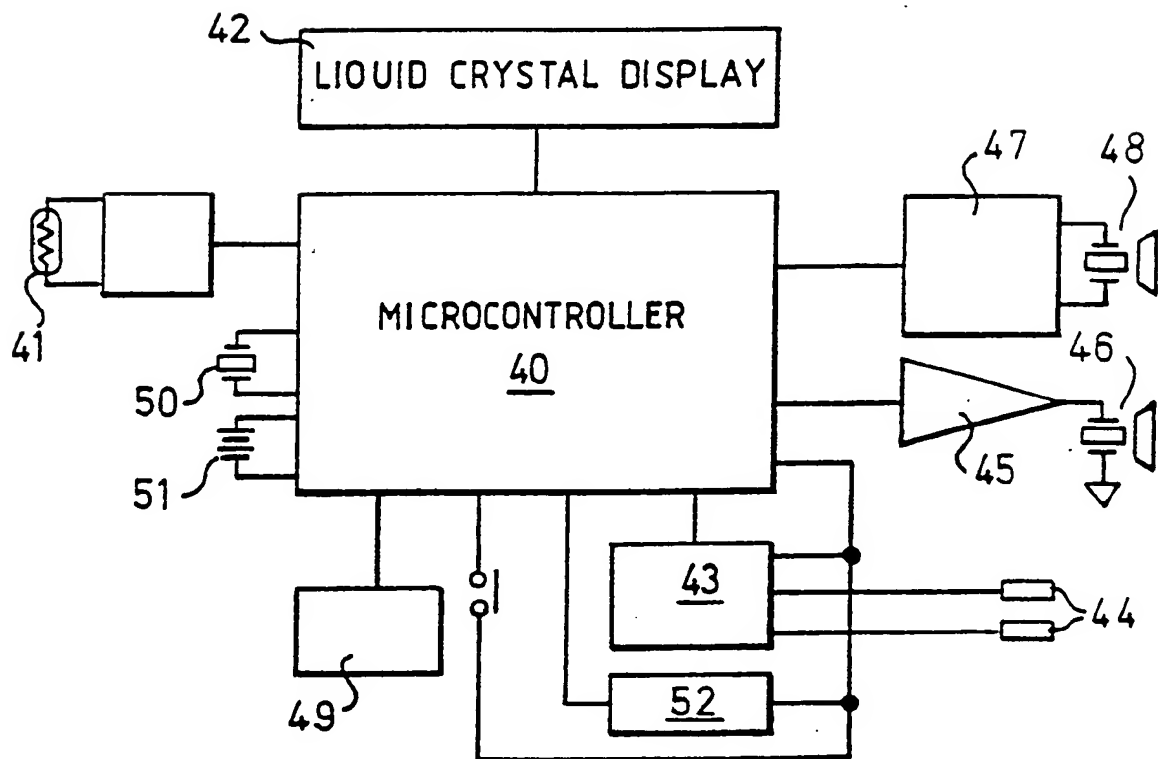
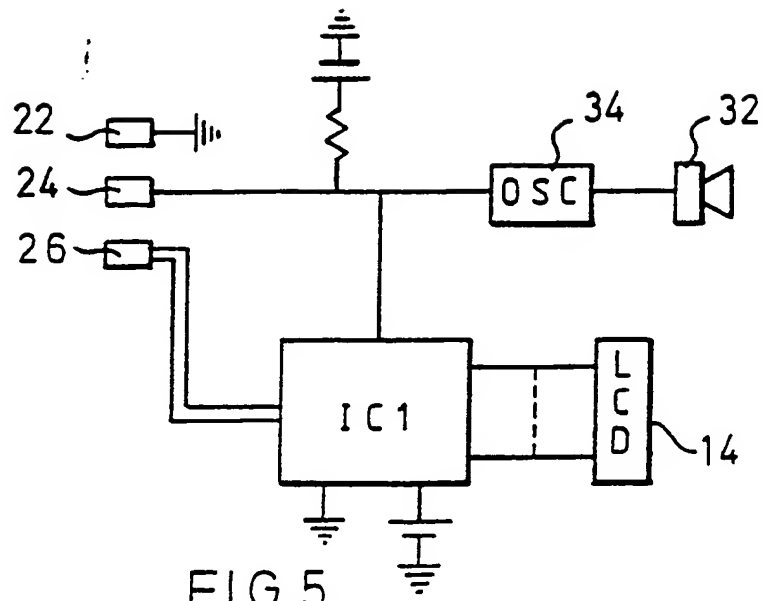


FIG. 6

INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 90/00713

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶ According to International Patent Classification (IPC) or to both National Classification and IPC IPC ⁵ : G 08 B 21/00																										
II. FIELDS SEARCHED <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black; margin: 5px 0;">Minimum Documentation Searched ⁷</div> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 30%; border-bottom: 1px solid black;">Classification System</th> <th style="border-bottom: 1px solid black;">Classification Symbols</th> </tr> <tr> <td style="padding: 5px;">IPC⁵</td> <td style="padding: 5px;">G 08 B 21/00, G 01 K 13/00</td> </tr> </table> <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black; margin: 5px 0;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸</div>			Classification System	Classification Symbols	IPC ⁵	G 08 B 21/00, G 01 K 13/00																				
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III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹ <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 10%; border-bottom: 1px solid black;">Category [*]</th> <th style="width: 70%; border-bottom: 1px solid black;">Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²</th> <th style="width: 20%; border-bottom: 1px solid black;">Relevant to Claim No. ¹³</th> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">Y</td> <td style="padding: 5px;">CH, A, 491451 (O. WOELKY) 15 July 1970 see the whole document</td> <td style="text-align: center; vertical-align: top; padding: 5px;">1-3, 5-8</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">A</td> <td style="text-align: center; vertical-align: top; padding: 5px;">--</td> <td style="text-align: center; vertical-align: top; padding: 5px;">4, 9-16</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">Y</td> <td style="padding: 5px;">Patent Abstracts of Japan, vol. 8, no. 179 (P-295)(1616), 17 August 1984, & JP, A, 5972031 (SHARP K.K.) 23 April 1984 see the whole abstract</td> <td style="text-align: center; vertical-align: top; padding: 5px;">1-3, 5-8</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">A</td> <td style="text-align: center; vertical-align: top; padding: 5px;">--</td> <td style="text-align: center; vertical-align: top; padding: 5px;">9-16</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">A</td> <td style="padding: 5px;">US, A, 4710755 (GURNEY) 1 December 1987 see column 2, lines 15-40</td> <td style="text-align: center; vertical-align: top; padding: 5px;">9-16</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">A</td> <td style="padding: 5px;">Patent Abstracts of Japan, vol. 7, no. 278 (P-242)(1423), 10 December 1983, & JP, A, 58156816 (MASAYA NAGAI) 17 September 1983 see the whole abstract</td> <td style="text-align: center; vertical-align: top; padding: 5px;">9-16</td> </tr> <tr> <td></td> <td style="text-align: center; vertical-align: bottom; padding: 5px;">-- ./.</td> <td></td> </tr> </table>			Category [*]	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³	Y	CH, A, 491451 (O. WOELKY) 15 July 1970 see the whole document	1-3, 5-8	A	--	4, 9-16	Y	Patent Abstracts of Japan, vol. 8, no. 179 (P-295)(1616), 17 August 1984, & JP, A, 5972031 (SHARP K.K.) 23 April 1984 see the whole abstract	1-3, 5-8	A	--	9-16	A	US, A, 4710755 (GURNEY) 1 December 1987 see column 2, lines 15-40	9-16	A	Patent Abstracts of Japan, vol. 7, no. 278 (P-242)(1423), 10 December 1983, & JP, A, 58156816 (MASAYA NAGAI) 17 September 1983 see the whole abstract	9-16		-- ./.	
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<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>[*] Special categories of cited documents: ¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"Z" document member of the same patent family</p> </div> </div>																										
IV. CERTIFICATION <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; border-bottom: 1px solid black; padding: 5px;">Date of the Actual Completion of the International Search</td> <td style="width: 50%; border-bottom: 1px solid black; padding: 5px;">Date of Mailing of this International Search Report</td> </tr> <tr> <td style="text-align: center; padding: 5px;">24th July 1990</td> <td style="text-align: center; padding: 5px;">14 SEP 1990</td> </tr> <tr> <td style="border-bottom: 1px solid black; padding: 5px;">International Searching Authority</td> <td style="border-bottom: 1px solid black; padding: 5px;">Signature of Authorized Officer</td> </tr> <tr> <td style="text-align: center; padding: 5px;">EUROPEAN PATENT OFFICE</td> <td style="text-align: center; padding: 5px;">Mm N. KUIPER </td> </tr> </table>			Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	24th July 1990	14 SEP 1990	International Searching Authority	Signature of Authorized Officer	EUROPEAN PATENT OFFICE	Mm N. KUIPER																
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III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category *	Citation of Document, " with indication, where appropriate, of the relevant passages	Relevant to Claim No.
A	Elektor, vol. 1, no. 5, July/August 1975, Elektor Publishers Ltd, (Canterbury, GB), "Temperature monitor", page 742 see the whole article	9-16
A	US, A, 4435095 (JONES et al.) 6 March 1984 see figure 1 -----	9-16

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.

GB 9000713

SA 36802

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CH-A- 491451	31-05-70	DE-A- 1929904	17-12-70
		FR-A- 2018287	29-05-70
US-A- 4710755	01-12-87	None	
US-A- 4435095	06-03-84	None	